SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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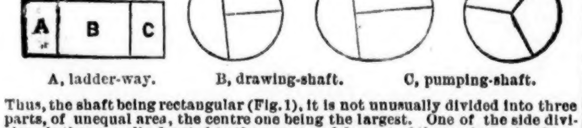
The Royal School of Mines, Jermyn Street.

MR. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURE LII.—Our last lecture (said Mr. SMYTH) having treated upon natural or spontaneous ventilation, it is necessary I should refer to some cases in order to show the extent to which that sort of ventilation is present in many mines, and may materially assist or check other means used. Experiments as to the amount of air passed in this way have been made in some cases with much accuracy, but in a rougher way experiments may be made constantly. Thus, in passing along a certain level in a metalliferous mine it may be difficult to keep a light in on account of the draught, and it would be a pity that so strong a moving power should be lost. I have explained to you how this pressure is set up by natural action, and that by putting in stoppings it may be directed for ventilating purposes to portions of a mine at a considerable distance from where the actual current is produced. On this principle the air may be carried through an extensive and intricate series of workings by spontaneous ventilation, and we have seen by actual examples that currents of air may be passed even where circumstances are unfavourable—that is to say, where the two shafts are nearly on a level, or where there is but a single shaft divided for the purposes of ventilation into two or more parts. Formerly a single shaft for each mine was a very common arrangement. The cost of sinking, as a rule, is always great enough to tempt managers, if possible, to do with one shaft alone. In order to make a single shaft available for ventilation, it is necessary that it should be divided into compartments, or "bratticed," to use the technical word, and the mode of bratticing shafts was formerly a matter of great importance. The occurrence of many terrible accidents, in which great loss of life has arisen, from the destruction of the bratticing and the annihilation, therefore, of the artificial ventilation, has led to the passing of an Act of Parliament, under which every mine must have two separate shafts. In the earlier stages, however, of mining there must of necessity be a time during which the exploratory work can be done only from one shaft, and if the companion shaft be at any distance some arrangement for ventilation is necessary before they are joined. In metalliferous mining so much of the earlier work is of an exploratory and tentative character that duplicate shafts are quite out of the question, although when the lodes are explored, and the works begin to assume the conditions of a mine, there will be often a number of shafts. Whether in metalliferous or coal districts, however, there will always be a time when bratticing in the shafts will be necessary, and in the workings we shall find that very often no work at all could be done without bratticing of one kind or another. In metalliferous mines shafts, which are used chiefly for drawing purposes, are bratticed, so as to secure the men from risk in passing up and down by the falling of pieces of ore or attle down the pit.

Fig. 1. Fig. 2. Fig. 3. Fig. 4.



A, ladder-way. B, drawing-shaft. C, pumping-shaft.

Thus, the shaft being rectangular (Fig. 1), it is not unusually divided into three parts, of unequal area, the centre one being the largest. One of the side divisions is then usually devoted to the ascent and descent of the workmen by skips, and has, besides, in many cases a ladder-way, with a series of platforms, each with a man-hole for the traveller to pass through. The middle portion, used for the purpose of drawing, should be cased by a strong partition, formed, it may be, of stout ribs across the shaft and planking, so that if anything falls there shall be no opening through which it might pass into the travelling section of the shaft, and strike the miners or others passing up or down. Carefulness in bratticing is, however, of far more importance when the shaft has to form the thoroughfares for two different currents of air, one current passing down by one division, and the second up the other. In former days, when coal mines were worked only by one shaft, it was a matter of prime necessity that the bratticing should be of a satisfactory character. In the case of an oval shaft, or of a circular shaft, it was not unusual to divide it, as in Figs. 2, 3, 4, the partitions being made of strong deals, 4 or 5 in. thick, planed true, and resting one upon the other—two being used for ventilation, and the other for drawing or pumping, the men often ascending or descending by the ventilation sections. In many cases of large shafts they would be divided into two equal parts by a strong brattice of stone or brickwork, perfectly air-tight, and not liable to accidents by fire—accidents to which wooden bratticing in shafts is especially liable, as being subject to a high temperature from the heat of the mine, it naturally becomes extremely inflammable, and in case of fire, if once ignited, its destruction, and with it all the arrangements for ventilation, is inevitable. Mr. Nicholas Wood, in some interesting papers on the subject of spontaneous ventilation, gives a remarkable instance which occurred in the North of England. He states that a deep pit of no less than 360 fms. was sunk to the coal of the Hetton seam in connection with the Seaham Collieries, and drifts, 336 ft. in length, were run at the bottom, when certain legal difficulties arose which stopped the progress of the works. The diameter of the pit was 14 ft., divided by a brattice, and on visiting it two years after he was surprised to find a high degree of spontaneous ventilation. He immediately set to work to obtain the exact facts, and he found the temperature at the bank was 44° Fahr., and at the bottom of the downcast 49°, while after going through all the workings, and arriving at the base of the upcast, it was 52½°. The consequence was that this average difference between the two shafts of 3½° of temperature was found to be quite sufficient to create a difference of 7005 cubic feet per minute, and this without any artificial aids whatever. In some cases a rate of circulation of from 30,000 to 40,000 cubic feet per minute has been reached, and in the great Hetton seam, in consequence of its being scientifically coursed and split, as much as 100,000 cubic feet per minute has been obtained by these natural conditions alone. Spontaneous ventilation, therefore, or the tendency of the air to set in any particular direction, is a most important point to be considered in arranging for artificial ventilation, so that the two may work together, so to speak, and the danger which results from a reversal of currents may be avoided. To this end it is extremely important to have a true view of the causes through which this "set" or action is set up. If we look back to 100 years ago we shall be surprised to find how much uncertainty and misapprehension prevailed on these points. By the earlier writers it was almost invariably laid down that the air descended the deeper shaft, but it was shown by some more careful observers that this could not be the fact in all cases. The first person who threw any true light upon the subject was M. Jars, who in the year 1770 wrote a book full of interest on coal mines, and especially treating upon the subject of ventilation. It has been translated, at the instance of the South Shields Committee, into English, and is well worth a careful perusal, as it very well explains the whole *rationale* of ventilation.

Passing now from these preliminary considerations, we will look at some of the methods by which the air is to be set in motion, and conducted down one division of a shaft and up another—how, in fact, we are to obtain a ventilating current where nature does not give it us; something more vigorous and less uncertain than those I have already spoken of. These methods are numerous, and as one or other is applicable under certain circumstances it is necessary that a mine manager should be well acquainted with them, as well as with the actual amount of engine power which may be required to get them in action. One of the simplest is a fall of water down the shaft, which mechanically forces air down with it. It is accompanied by the disadvantage of having the water to pump up again, except in rare cases, where there may be an adit by which it will run off, but an action of this kind is applicable to certain temporary purposes, and is often found to be of great service. Suppose, for instance, in a deep working carbonic acid gas is largely present, fresh air may be got into it in this way; or in case of an explosion by which the furnaces are extinguished, and the mechanical power obtained from them is lost, then a fall of water is an able auxiliary, by which a sufficient quantity of air may be passed through the workings to serve until the ordinary ventilation be restored, and when it falls from a height of 300 or 400 yards each drop carries some air before it, and creates a pulsation in the air which can be felt. It may be regulated by certain contrivances, such as that in use in the Pyrenees, called the "tromp" or native blast—a simple apparatus applicable in driving exploratory drifts. Another form of machine is employed for this purpose in the Cornish mines, and is applicable when there is a high fall of water to draw the air into the face of the workings These devices are only applicable on a small scale, and where larger volumes of air are required other means must be used. When it is expedient to carry the air along the side of a drift air boxes are used. These are sometimes cut in the rock at the side, about 2 ft. in diameter, and closed in with boards, and to prevent leakage the joints are plastered with clay, and in this way a draught of air may be carried a considerable distance. This was, no doubt, the beginning of the system on which all large ventilation must be done, and instead of a mere box air-ways are constructed of a very considerable calibre. Sometimes plans are adopted for convenience sake, or for a limited time, which are not always advisable as a regular thing. Thus, in driving an adit for a large district the necessity of a separate drift may be avoided by putting in a roof, and so letting the air pass over. At the great tunnel of Mont Cenis, where they are unable to get air down by means of shafts, and where it must consequently be brought in from the mouth of the opening, they carry an arch-way below the level, and force the air through by a powerful apparatus. The great adit level at Schemnitz, in Hungary, under the Seigelsberg Mines, 1¼ mile long, without the intervention of a shaft, was carried out by adopting the plan, usual in our collieries, of running two drifts parallel with each other—one as the main drift, while air was forced through the other, and then, being passed into the main drift, supplied the workmen with the means of breathing.

I now come to the methods by which satisfactory currents of air can be carried continuously through the mine. Some of these are remarkably simple, and have been practised with more or less effect for the last 200 years. In the Midland Counties, for instance, when the air will not move, it is not unusual to suspend a pan of burning coals in the shaft, which may be lowered or raised by a windlass; but although useful for many temporary purposes, it is vastly inferior to a regular furnace. The effect of a pan of coals is simply to destroy the equilibrium between the upcast and downcast shafts, and thus put the air in motion; and it was probably this practice which led to furnaces being placed at the summit of the shaft. The proper place, however, for the furnace is near the bottom, and then, by heating the whole column of air in the upcast shaft, a rapid and powerful circulation is obtained. This system, which in collieries is often carried out on a large scale, is at present the most effective yet known, no less than 120,000 cubic feet per minute being passed in some cases—as, for instance, at the Monkwearmouth Colliery, where the furnace is 12 ft. in width, with 3 ft. above and 3 ft. below the fire-bars. It is placed usually, according to circumstances, at from 20 to 40 ft. from the bottom of the shaft, generally in the plane of the seam, with great precautions to prevent the coal taking fire. When there are large quantities of gas present, the air from the mine is prevented altogether from passing through the furnace, but is conducted up an inclined drift, opening at 40 or 50 yards higher into the shaft, called a "dumb drift." In cases of this kind the fresh air necessary for the combustion of the furnace is introduced into the mine from the surface. In managing a furnace a very important point is to have a very thin fire, which is maintained by small quantities of fuel being thrown on at a time. Nothing is more wasteful than the practice of throwing thick masses of coal into the furnace, producing for a long time nothing but smoke until it bursts into a flame. Smoke is the evidence of an imperfect combustion, and, this, therefore, is a most important point both as to the quantity of fuel consumed and amount of heat produced. It is, however, not an easy thing to get careful and intelligent firemen, and their work, even in the best collieries, is often much neglected. The practice of firemen too often is to "bank up" the fire, and take a siesta. If the fire is well kept up an average temperature of from 140° to 160° Fahr. may be obtained, which, compared with the temperature of the downcast shaft, will give a ventilating power of from 80° to 100°. In this way it may be calculated what is the amount of air moved for a certain amount of coal consumed, and also the effects of a furnace against machinery moved by steam power. A furnace has a decided advantage, to begin with, in being easily attended to, and not likely to get out of order, although it may not be always so economical as the better kinds of machinery. One objection to the common furnace is, that if a furnace of a certain size is put in we cannot afterwards increase the amount of combustion, and, therefore, the amount of ventilation. To obviate this the late eminent viewer, Mr. Wales, suggested an arrangement, which was afterwards completed by Mr. Dalgleish, for making the bars of great length, so as to allow either the shifting of the place of the fire, so as to permit that part to be cleared without interrupting the ventilation, or to permit of a vast increase in the fire, whilst by a series of doors the air was regulated either above or below the fire-bars. There are other modifications and improvements more or less adapted to the present time, and a very much larger amount of air can be passed in this way than by any machinery whatever. The amount usually moved by three furnaces, playing into one large upcast shaft, 16 ft. in diameter, is about 200,000 cubic feet per minute. Other plans have been tried for heating the air in the upcast shaft, and iron tubes highly heated by steam have been employed for this purpose, but although supposed to be safer, the ventilating results are not equal to the furnace. A few years ago a great deal of excitement was created by the introduction of steam-jets. The theory of the inventor, Mr. Goldsworthy Gurney, was that the jet acted like a piston, and drew or drove the air up the shaft. After a time it was found to produce better results by letting the steam escape by a network of small jets instead of at a single orifice; but, on the whole, it soon became obvious that it was a plan quite incompatible with the requirements of a large colliery. In some of the experiments made by the late Mr. Nicholas Wood it was found that by one jet, 4 in. in diameter, 17,000 cubic feet are moved per minute, and with small jets, ⅜ to 3-16th of an inch in diameter, 22,000 cubic feet. A furnace in the same pit, with the same amount of fuel, raised the temperature at 55 fms. deep to 140° or 145°, and moved 22,570 cubic feet of air per minute. So much, then, for the means of creating a draught or ventilating current, but what is after all only a part of ventilation, as we may get a hurricane of wind down one shaft and up another, and yet the workings below may be completely unsafe. We might have two shafts in close proximity, and then the air would take the shortest course from the one to the other. This is, in fact, the principle or basis of all systems of ventilation in collieries, and the great thing is to use that property of the air so as to carry it even to the most remote and distant corners of the mine. "Distribution," however, forms a separate subject, in considering which we shall find how important it is not only to get the fullest amount of power from the furnace, but to arrange the distribution so as to enable the miners to work in safety, and in comparative ease and comfort.

LECTURE LIII.—We have been considering a branch of the subject of ventilation of the very highest importance—namely, the mode of dealing with those cases in which the action of natural causes is insignificant, and incapable of creating a proper current of air through the shafts; and we have devoted ourselves hitherto to the creation of such currents at one particular point, but this is not what properly could be called the ventilation of a mine. After the current is obtained, it is only by the subsequent distribution of the air through the workings that anything like a proper ventilation can be obtained. I enlarged a little in the last lecture on the various forms of furnaces used in collieries, and mentioned the experiments that had been tried for substituting in the place of furnaces jets of high pressure steam, and I need not now go back to any of those points. You will have seen that the furnace principle admits of a great variety of application, but in all it requires that certain conditions should be observed. That is to say, the shafts should be of considerable depth, so as to get a long column of rarefied air, and, therefore, much lighter than the colder column of air passed in by the downcast shaft. Then, the upcast shaft should be protected from the movements produced by the action of the pumps, or by the machinery for raising the coal, or from falls of water; providing, in fact, against all influences or movements which would lower the temperature, or mechanically retard the movement of the heated air. I have more than once stated that under certain circumstances of atmospheric pressure the emanation of noxious gases is greater than under other circumstances; but it may be necessary to add that it is extremely desirable, both for persons interested in a colliery, who are on the spot daily, and for those who are at a distance, and who may require to know its condition, that registers should be duly, carefully, and unremittingly kept of the amount of air passing through from time to time, and the readings of the barometer. There should in all cases be a book kept at the mine, arranged in properly tabulated leaves (and corresponding sheets where copies have to be sent by post) for each 24 hours, showing the amount of air passing through the workings, the total quantity going in by the downcast shaft and that coming to the upcast shaft. There are a number of very ingenious contrivances and mechanical appliances for taking these measurements by which the quantity of air at different points, the rate at which it moves, and other facts are determined with great exactitude. Mechanical contrivances, too, are frequently used for the purposes of creating currents of air through the mines when the natural ventilation is not sufficient, or where it is not desirable or safe to use furnaces. These may be divided into two classes—the one by which there is an alternating motion, and the other (including fans) by which a rotary motion is given to the air. If we attempted to take up a description of all these machines, and of all the contrivances for creating air currents, it would occupy a vast amount of time, and I shall, therefore, only mention a few of those actually employed, and which for that reason it may be supposed the public think are the best. Some of these appliances are very ancient, and if you refer to the old book of Agricola, which I have often quoted, you will find that great attention was paid long ago to apparatus of this kind, some of which were not very different to those in vogue at this day, and particularly those of the nature of rotary fans.

One form of machine for creating a current of air is the air-pump, working with a stroke of from 3 to 8 ft., which many years ago was, and to this day is, common in the Hartz mines, and not only there but in this country also, where in the metalliferous districts it is called a "duck machine." Its later developments have been chiefly confined to increase of its proportions and powers, and thus enlarged it is capable of doing a great amount of work. It is very simple; one box dips into another box, which is kept full of water; then there passes through the bottom of this box a pipe, which is nothing else than a continuation of the air-pipe in the shaft, and at every stroke of the piston the air is let out by means of a valve, and so forced into the mine. In fact, the air is taken in like water into a pump-bucket, and driven out in a similar way. The drawback upon this machine consists in large works in the inevitable complication which results from the accumulation of a great number of valves. This system has been most successfully employed in Belgium, where the cylinders are made from 10 to 15 feet diameter, and thus bring out an enormous amount of air at each stroke. Great exhausting cylinders of this kind are employed with immense effect at the gigantic tunnel of Mont Cenis to extract the gunpowder smoke. The most powerful which has ever been erected is the double-acting ventilator of Mr. Struvé, of which there are several admirable examples at work in South Wales. The piston has a 6-ft. stroke, and is from 16 to 24 ft. in diameter. The piston works up and down in water, and by means of ranges of valves above it and below, placed on the walls of the piston chamber, air is drawn in and forced out at each up and each down stroke. The simple manner in which it works is a great advantage, but a good deal of care is necessary to keep the valves in order. At the famous colliery at Risca there is one of these machines, which has two pistons, each 18 ft. in diameter, with a 6-ft. stroke, worked by a small steam-engine, 35 lbs. to the inch, by which 43,000 cubic feet of air are passed per minute. This is a respectable amount to obtain, but when we go to the larger machines we find them capable of producing a much greater amount of ventilating power.

Another class of pumping machines, which have their origin in the Belgian collieries, are worthy of note. So long ago as 1828 a machine was suggested with horizontal cylinders, and this led to the erection of one or two on a most enormous scale. At Charleroi, two cylinders are placed side by side, each 10 ft. in diameter. These are worked by a moderate sized steam-engine, and are capable of extracting nearly 50,000 feet per minute. Beyond all these, however, in magnitude is what is called Nixon's ventilator, of which there is a fine example now at work in the Navigation Colliery, at Aberdare. The pistons are 30 by 22 feet, so that they have, in fact, an area each of 660 feet, and that body of air is pushed to and fro by a 7-feet stroke, so that the velocity of the air may be readily calculated. The valves are 672 in number, and rectangular in shape, being 16 by 24 inches. Worked at the rate of 9 strokes per minute, the machine would expel 166,000 cubic feet of air per minute. An allowance, however, must be made for a good deal of loss by friction and leakage. As far as I am aware, this engine has only been put up at one place, but double machines of this kind are so powerful and so convenient, that we cannot help hoping that they may be tried elsewhere, in competition with other systems. Employed in connection with furnaces, they would produce a ventilation of most powerful nature.

Rotatory machines are based upon the principle indicated by their name. Some years ago a contrivance something like an Archimedian screw was tried for the purpose of extracting the air, but it did not give satisfactory results. The oldest, however, as well as the most general, of these appliances partakes of the fan principle. One of the most common is the simple radial fan, in which the air being taken up at the centre by the vanes, to which a rapid motion is given, is driven out at the side. By a succession of these the air may be carried to the most distant workings. [Mr. Smyth here exhibited a number of models of the earlier and simpler fan, by many of which the currents produced were very considerable.] These machines are exceedingly suitable to give a sufficient amount of ventilation at the end of levels, where one or two persons only are at work, and where it might be difficult to apply any other method, but they are by no means suitable for large workings. The velocity of the vanes necessary for the introducing of a large amount of air is very considerable, and, therefore, whenever anything should happen to reduce that velocity, or as it might happen altogether to stop the action, the ventilation would, of course, be completely interrupted. For this reason the simplest class of fans have been generally rejected as a means of producing a large amount of air. They have been, however, found of extreme value in cases of emergency, from accidents or otherwise. Several makers have introduced fans more or less of the radial description, vary from 10 to 20 feet in diameter, and generally applied vertically. Another form proposed gives the fan curvilinear arms, and the air, by a very rapid rotation, is driven out at the sides. A large model of this description is in the model-room upstairs. The application of fans is extremely various, but only in a few cases have machines of importance been produced. One of these, by a mechanician named Fabry, has obtained great favour among the French and Belgian colliery viewers. It has two axles, fixed parallel to each other, and two wheels, like great cog-wheels, of three teeth each. These teeth in revolving are so arranged as to fit in between each other, and are made to go round at a rapid rate, within a closed casing of brickwork. They revolve in opposite directions, and the foul air is driven out with great effect. From 15,000 to 20,000 cubic feet of air is thus displaced, but although suitable to collieries like those of Mons and Valenciennes, where they give much satisfaction, these machines are not so applicable to the large collieries of this country. Another machine, that of M. Lemielle, after having been in existence for 12 or 15 years, has of late suddenly attracted attention. It was put up in 1850 in many continental collieries, and, in spite of some theoretical objections made to it, attained a considerable amount of celebrity in those countries. It was put up about the same time at a small colliery at Bristol, and was worked for many years without attracting any notice. At last some of the northern viewers visited it, and, forming a good opinion of it, several have been put up in the North, on a gigantic scale. Experiments are going on, and its merits are still sub-judice; but it seems to be capable of doing a great amount of work, at an economical rate. It consists of a cylinder, with another working inside it, but the inner one is placed eccentrically. It has three valves, or shutters, on the rim of the inner drum, which, by means of iron rods moving freely round an elbowed axis in the centre of the large cylinder, lie close to the drum in one part of the revolution, and open in the other. The effect is that the air is admitted on the side where the shutters lie close, then in the other part of the revolution the shutters opening drive the air out by a prepared place of egress in the outer cylinder. The valves, or shutters, act on the same principle as the feathering paddles of a river steamer. The great advantage of this machine is that it is worked at a slow speed, and is not liable to get out of repair. Another of the fan tribe has also attracted much attention, and is believed to be a very decided success. It is the invention of M. Guibal, a Belgian mining engineer of eminence, and besides much simplicity and strength in the construction of the fan part, it offers some advantage in respect to the orifice through which the air has to pass after leaving the fan. It is turned into a trumpet-shaped chamber, or stack, so that it can expand as it goes out. These fans are 30 feet in diameter, and 10 or 12 feet in breadth, like a large water-wheel, and are obviously capable of carrying before them a large amount of air, although worked at the moderate velocity of from 10 to 16 revolutions per minute. Smaller fans, from 16 to 20 feet in diameter, and making 40 revolutions per minute, pass a quantity of air formerly thought impossible by the means of such apparatus. Within the last few years a marked improvement generally has been made in fans and artificial ventilators of this kind, and it is possible that eventually they may be found preferable to furnaces. At present, however, furnaces are believed to have the advantage where the shafts are perpendicular. They are easy of management, and so well understood by the men, that there is a strong prejudice in their favour. On the other hand, mechanical ventilators are apt to get out of order, and thus to endanger the efficiency of the ventilation and safety of the mine. The respective merits of the two systems are exciting discussion,

which becomes more earnest every day, and the question within the last few years has been fairly taken up in those districts in the North of England where the engineers are most ready to adopt improvements, and where they have capital, and opportunities for trying experiments.

LECTURE LIV.—In the last lecture I sketched a few of the mechanical apparatus for ventilation, of which so large a number are brought continually before the mining world, for the purpose of forcing large bodies of air into mines; and although so lately as but ten years ago there were doubts commonly entertained whether anything like a strong ventilation could be produced by such means, there is now a wide choice between machines of large dimensions and powers which have proved themselves capable of effecting this result with great economy. I mentioned, as amongst the most notable of these, the air-pump of M. Struvé, used in Belgium and South Wales; the horizontal machine of Nixon, on a large scale; and two machines on the fan system invented by Lemielle, and Guibal. I, however, omitted to state that two or three of Guibal's fans have been erected at Pelton, at Elswick, and at several other collieries in that neighbourhood, and more recently at Gethin, in South Wales, of dimensions somewhat larger than usual, being 29 ft. 6 in. in diameter, by 10 ft. in width. Several of these on being tested have been found to move a volume of air exceeding 100,000 cubic feet per minute. This being the case, it has been found possible to obtain a sufficiently powerful current of air passing down into the mine by one channel, and out of it by another, as well by these means as by furnaces. Having achieved so much, the next question is how to distribute the current of air so obtained through the mine. If we take the case of a shaft divided by a brattice, where the arrangement for creating a current of air is made so as to pass it down one side, it is obvious that to be of any use it must be made to visit all the workings, and so pass from one to another, until it comes back to the shaft and goes up the other side, which forms the upcast. I may mention in passing, however, that there is great danger indeed in thus trusting to a single shaft. In such a case as I have supposed it is obvious that any accident to the bratticing would stop the ventilation altogether, and several most appalling catastrophes have taken place, and great loss of life has resulted. Accidents to bratticing are due to several causes. If the bratticing be made of wood there is a liability that it will take fire, and being exposed continually to a hot temperature, the wood is usually in a highly inflammable condition, so that if once ignited the flames, rising through the shaft, consume all before them, and a very short space of time suffices to reduce the brattices to ashes, destroying the ventilation, and cutting off all possibility of the men in the workings escaping, even if they succeeded in reaching the bottom of the shaft. Moreover, if the brattice be constructed so as to be fire-proof, which is often done, it is still liable to be broken down by accidents to the machinery and by other causes, and then, the ventilation being gone, the men below are destroyed by choke-damp. Except in exploratory works in the earlier stages of a mine it is requisite, therefore, to have two shafts, which are frequently for the sake of convenience placed at no great distance from each other. Indeed, it is now made compulsory by the Legislature that each colliery, &c., shall have two shafts, so that in case of accident closing the one, the men may escape by the other. When the shafts are sunk to the bed it is proposed to work, a drift is made, so that they are placed in communication with each other, and this is one of the first works carried out. When this is done it is obvious that if the air is to pass round the other levels afterwards made, the first communication between the shafts must be closed in some way so as to make the air take the longer route. It may be advisable to close it permanently, and then stonework or brickwork is used. On the other hand, it may be necessary to use the passage every hour of the day, and then some sort of door must be put in. This brings us to a different class of arrangement, by which the current of air may be interrupted otherwise than permanently, and so as to allow a passage through from time to time. Doors in such situations must be of the very strongest construction, and are generally two or three in number, at suitable distances, so that if one were destroyed by an explosion the others would still exist to continue the ventilation, and yet allow the men to escape to the shaft most favourable for that purpose. The underground works of a mine commence by the men driving a pair of levels parallel to each other. For some little distance each is worked by such natural ventilation as may be obtainable from the pits, or be created by a brattice, but it soon becomes necessary to make a cross-cut—that is to say, an opening from one level to the other. That being done, the air passes along one level through the cross-cut, and back by the other level, and a circulation is thus established. The levels are then pushed on until at last they advance so far that it is necessary to bring the air closer. This is done by making another cross-cut, and by closing the former one, compelling the air to make a longer journey, and furnishing another starting point, as it were, from which they may push on to the next thurling. This goes on till the drifts are completed, and the currents of air so obtained are only limited by the friction encountered, or the resistance met with. Permanent stoppings are generally constructed of the rubbish obtained in the workings piled up to a considerable thickness, but care must be taken to have it well put together, as such masses have a tendency to settle and leave spaces at the top. When this happens a portion of the current is diverted from its proper course, and so when it has been conveyed any considerable distance the quantity which reaches the extremity is much less than it ought to be, that which is lost having availed itself of these openings by the way to find the upcast shaft. It should never be forgotten in making these arrangements that the air always takes the shortest route. This fact naturally produces a considerable pressure on stoppings and doors. This is so notably the case in some collieries that the stoppings are faced with brickwork—that is, a thin brick wall is erected, and backed up with a quantity of stone and rubbish in order to make it as strong as possible. This is of the greatest importance, as if one of these stoppings should be blown out by an explosion all the workings beyond would be deprived of air. With regard to doors, a description of each will give a good idea of their uses and construction. They are of various descriptions.

Main Doors are employed to shut off one part of the mine from another, and thus prevent the air taking any particular short course, such as I have described, and these may be constructed to open against the pressure, so that they are kept closed on the other side. They are made in an extremely permanent manner, with strong sills, because in case of explosions it is of the greatest importance that they should stand the shock. They are put in in pairs to prevent the great leakage which would attend the action of a single door, and in such a way that when one door is open its partner is closed, and the general ventilation is not interfered with. Every one of these doors requires a person to be constantly stationed at it, whose duty it is to keep it closed when the passage of trucks through it has been completed. Boys are usually placed to attend to these doors, to pull them open as the trams approach, and close them after them; and although much commiseration has been bestowed upon the little fellows doomed to this kind of work, it is found to be much better than any plan of self-acting doors yet devised. The great point, however, in the more modern systems of working is to do away with the use of doors as much as possible. Although it is well known by the men that to keep these main doors open would have the effect of stopping the ventilation, or if not entirely doing so of greatly weakened it, they sometimes when working near are foolish enough to prop open a door for some trifling temporary convenience, and thus the atmospheric conditions of the mine are made more liable to explosions, which have not unfrequently occurred from such practices. At a recent explosion in a mine in Staffordshire it was clearly proved that the ventilation was thrown into a bad condition by one of these main doors being kept open for a length of time by an accident to a truck while passing through. The current, instead of going upon its ordinary and intended route, rushed through this open main door, and found a nearer way to the upcast, leaving all the rest of the mine without its usual supply of fresh air. The explosion probably would not have happened if the main door at that place had been dual. Indeed, for greater security there are sometimes three main doors placed together in lieu of only a pair. Sometimes the doors are made to be self-acting, but a better plan is that in use at some of the collieries in the North of England, where an enormously strong door is placed in the level between two main doors, and suspended from hinges attached to the roof. It is kept up by a catch, to which is attached a board hanging athwart the level, so that in case of an explosion the blast sweeping along with force enough to break the main doors would act upon the board, and release the catch. The reserve door would then come down and take the place of the main doors, so as to prevent the ventilation from being destroyed; and, being suspended on hinges, any men trying to escape to the pit could push it back sufficiently to allow of their passage. At the late Exhibition at Paris plans were exhibited of the St. Etienne Colliery, from which it would appear that some remarkably clever spring doors of this kind are used there.

Sheth doors are used to turn the course of the intake air into the bords where the working is going on, and for this purpose a bratticing is required which may be put in in a light way, so that it may be removed from time to time as the workings progress; and the sheth doors, which in the same way do not require to fit very closely, turn the air from the main air-ways along these bratticings.

Dam doors are chiefly employed in mines subject to spontaneous combustion, and are put in as precautions. Thus, when a fire breaks out the dams are closed, and it is shut off from all access to the dangerous parts of the workings until measures are taken for the extinction of the mischief. To be efficient, these dams must be constructed to be air-tight. At the undersea collieries, at Whitehaven, there are peculiar conditions which render them remarkably liable to spontaneous combustion, and it is remarkable how completely all danger is there obviated by the facility with which the fire is isolated by means of a most efficient management of dam doors. A fire produced in the mine, and particularly by the spontaneous combustion which arises in the small coal of certain seams in a short time, makes such a smoke and "stythe" that it can only be approached on the windward side, and frequently it is needful to retire to some distance, and bar off or isolate a whole district. To meet such cases the frames of the dam doors should be prepared beforehand at suitable spots in the main drifts, and they then perform excellent service. In the case of the undersea collieries, to which I have just alluded, the Earl of Lonsdale judiciously had the lintels, &c., of dam doors prepared in the stone drifts between faulted districts of coal. It has been proposed to put in swing doors, such as I have described for damming. If this were done they would be made to swing as before from a strong framework above, so that in case of a fire, instead of losing the time required to put in the ordinary dam doors, these could be let down, and particular districts of the mine almost instantaneously isolated.

Man doors are used in some of the large collieries to enable the manager or his deputy to get at the return air for the purpose of examining it, instead of having to travel an enormous distance round. These, however, must be kept carefully locked, to prevent the men from getting through, and ought to be examined from time to time as to their integrity.

Sham doors, to check the current of air, are occasionally used, and in small mines, and in some parts of larger ones, it is not unusual to employ sheets of tarpauling to turn the air in any given way.

I mentioned in one of the earlier lectures that men who could work in the dark could, under certain circumstances, command a premium, and such work is sometimes required in putting in brattices where the ends of the levels are filled with noxious gases, into which it would be dangerous to take a light. In these cases the men can only work a few minutes at once until the bratticing is complete. In many cases much time is lost, and many lives have been sacrificed, by not keeping the bratticing close up to the working parties. The bratticing practically divides a horizontal level, just as I have shown you a shaft is divided, one side being the intake, and the other the return way. A moment's consideration will show you that if the bratticing be properly done, and there is a good current in the main drifts, an ample supply of air may be obtained for long distances without the cost and labour of making frequent cross-cuts. The latter, however, must not be too long delayed, but it is impossible to lay down any general rule on the point, as the engineer must be guided by the circumstances of each particular case. These brattices are generally made of thin deal, although of late years a great deal of use has been made of a sort of tarpauling, which has been found to be very convenient, and more easily put up and removed when done with. This material has especially been found useful after explosions, for the rapidity with which it can be put up, and a temporary ventilation obtained.

INSTITUTION OF CIVIL ENGINEERS.

The annual *conversazione* of the Institution of Civil Engineers, given by Mr. Charles Hutton Gregory, its President, took place at the society's house, Great George-street, Westminster, on Tuesday evening, and was very numerously attended. The increased amount of comfort resulting from the recent enlargement of the building added enormously to the agreeable nature of the gathering, and those who exhibited models may fairly congratulate themselves upon the far greater facilities afforded by the enlarged space at disposal for explaining them to those present. Amongst the exhibits in which the readers of the *Mining Journal* will be more immediately interested the model of the machine by Mr. S. P. Bidder, jun., for breaking down coal without the use of gunpowder is, probably, entitled to the most prominent notice, and the same gentleman's safety-lamp is also an admirable contrivance. Models of coal-cutting machines being exhibited by Mr. S. Firth (Firth, Donisthorpe, and Co.), Mr. W. E. Marshall (Carrett and Marshall), Mr. C. J. Chubb, and others, their relative merits could be readily judged of. Mr. H. R. Marsden was there with an excellent working model of Blake's stone-breaker, which has now become one of the indispensable necessities of mines, and is, unquestionably, the most efficient machine at present known for the economic breaking of stone of all degrees of hardness and of all sizes—even the little model shown on Tuesday evening was breaking down cubes of road-metal, from 1 to 2 in. in size, as though it had been walnuts, although the entire size of the machine was only about 1 ft. by 8 in., and 8 or 9 in. high. Mr. F. B. Dœring and Mr. J. D. Brunton showed mining machines, the first being designed for drilling purposes, and the second for driving a tunnel complete 7 ft. or more in diameter. Mr. Brunton's machine is a very elaborate affair, consisting of several series of rotating cutters, arranged to follow each other in spiral lines, the whole being operated by wheels and pinions suitably arranged. Mr. C. Hodgson's Wire-Rope Tramway, which is just now creating a large amount of attention in mining circles, was represented by an excellent model; and Mr. Joseph E. Holmes showed a model of his stone-dressing machine, and of an improved and cheap form of engine-counter, which were well worthy of examination by those interested in the economic working of quarrying and other enterprises. Mr. J. C. R. Okes, an Associate of the Institute, exhibited two models of universal steam-pumps, which appear to possess merits which will ensure their very general adoption as soon as they become known; these pumps are simple in the extreme, and it is difficult to see how they could under any ordinary circumstances get out of order. Mr. Scott's patent wheel-moulding machine; Mr. Lintock's patent metallic packing (exhibited by Mr. Fred. Tuxford); Mr. Alexander's model of self-acting signals; Mr. Barnes's model of proposed method of coupling the vertical and horizontal wheels for the Mont Cenis locomotive engines; and Mr. Bartholemew's model of hydraulic hoist were also carefully examined, and their merits pointed out and discussed, so that in the course of the evening a large amount of valuable information was gained in a most agreeable manner. As it would be impracticable to give even an outline of the several inventions and propositions brought forward by the *conversazione*, it must suffice to refer in greater detail to a few of the more important of the inventions and models exhibited.

THE UNIVERSAL STEAM-PUMP.—In last week's Journal an illustrated description of the pump now being introduced by Messrs. Hayward Tyler and Co., and the working model exhibited by Mr. OKES, Assoc. Inst. C.E., on Tuesday evening, could not but create a favourable impression of its value. The model was a very neat one, some 6 in. in length, worked by compressed air, duplicates of every part being provided, so that the visitors could examine the whole of the working parts for themselves. Its simplicity was much admired, there being only two moving parts in the engine—a piston, with a cylindrical steam slide-valve within it, actuated directly by the steam, by the main piston passing over certain ports or openings in the steam-cylinder, the valve moving in the opposite direction to that of the piston. No tappits, springs, or other contrivances are require to produce the reciprocating motion. The engine (with its steam-piston and slide-valve, self-contained within the cylinder) is bolted upon the cover of the pump-barrel. Thus the whole of the machinery is perfectly independent of bed-plate, and may be placed in any convenient position, no accurate adjustment of level being necessary. No working parts of the machine being exposed, no injury can result from its being fixed in dusty or dirty places, where it would be impossible to place machinery of other descriptions having moving parts exposed to the wear and tear of grit getting into the bearings. The only moving part visible is about a couple of inches of piston-rod, which, of course, could be cased in if required. Were it not for seeing the piston-rod gliding backwards and forwards through the glands, or stuffing-boxes, no one would suppose the machine to be at work, its action is so noiseless. The engine has neither fly-wheel, crank-shaft, bearings, eccentrics, connecting-rod, pins, joints, tappits, springs, nor small valves to regulate the action of the steam. It can be worked at an extremely slow rate of speed, below 10 strokes per minute, or at a high rate, above 300 per minute, by simply regulating the admission of steam to the cylinder. There are no "dead points," as in a rotating-engine, steam being always "on" at one side or other of the piston, so that the engine will start at any point whatever upon admitting the steam. The pump itself is extremely simple in its construction, and the valves are accessible without removing or disconnecting any of the pipes. No joint whatever need be broken, with the exception of that of the air-vessel, the removal of which exposes to view the whole arrangement of valves. This joint is readily broken and made, as the surface of the pump to which the air-vessel bolts, as well as that of the air-vessel itself, is "planed;" consequently, the simple removal of and replacing of four bolts is all that is necessary, the whole operation not exceeding a few minutes. The valves are of gun-metal, leather, or India-rubber, as circumstances require, the pumps being equally applicable with such modifications as these to raising water from wells, mines, quarries, &c., filling tanks, supplying steam-boilers, and to almost any other purpose.

ROCK-BORING MACHINE.—The rock-boring machine invented by Mr. F. B. DŒRING, and which for some time worked most successfully at the Tincroft and other mines, is well known to the readers of the Journal, but in the model exhibited on Tuesday some modifications had been introduced, in order to adapt the machine for quarrying and shaft sinking. By this arrangement the machine is supported on a body of water on two outside cylinders. As the advance of the machine is required, the water is discharged into a tank by the advance piston opening a valve for the purpose. This piston can only act when the main piston carrying the tool passes a certain port, in communication with the cylinder of the former piston, the tool having penetrated a certain depth in the rock. When it is required to return the cylinder to its original position, in order to replace the tool, compressed air is admitted into the tank, and presses the water into the two carrying cylinders, raising the whole machine to the top of the carrying bars. In stone of ordinary hardness the machine will bore holes at the rate of from 4 to 6 inches in depth per minute, and in the hardest granite at from 2 to 3 inches per minute. For this a working pressure of 30 lbs. on the square inch only is needed. The engine can be worked either by compressed air or steam. The main piston and piston-rod, to which the boring tool is attached, are made in a single piece of cast-steel, and are not in any way connected with the other working parts of the machine, an essential condition for success in rock-boring machinery. A great advantage claimed for this machine is that the main piston distributes the motive fluid in such a manner as to avoid all back pressure while the tool is striking. The valve being held over in its position at each stroke until the piston has done its work, the greatest possible effect is gained from the power applied. The working parts in this machine are reduced to a minimum, and consequently also the wear and tear. It is perfectly automatic.

SYNCHRONOUS CLOCKS.—That punctuality is one of the greatest, if not the greatest, preventive of railway accidents is universally admitted, and to ensure it synchronism in the clocks is quite necessary. To facilitate this synchronism, Mr. W. S. HARRISON, of the Commercial-road, Peckham, has introduced a system of clocks, which are so constructed that they may be set to time with any amount of error, either fast or slow, by a current of electricity. Many years ago, the Astronomer Royal supplied to most of the principal towns the means of determining Greenwich mean time, by sending at one o'clock each day a current of electricity from his normal clock, corrected to the last hour's observation. Since that time this current has been used for the purpose of setting highly-finished regulators; where the error has not exceeded five seconds, fast or slow, or where the clock has had a gaining rate, the mechanism of which being so arranged that it should rest at one P.M. until the receipt of a current of electricity, when the clock would resume its functions, and indicate the true time for that hour. Among the advantages claimed for Mr. Harrison's synchronous clocks are, that they will be corrected for any error, fast or slow; that the hands are set by the motive-power of the clock, and not by the electric current, as formerly. By this arrangement great power can be obtained to insure its perfect action, while the discharging force of the current may be feeble or strong; no electrical break in a line of clocks, however distant or numerous, is required, thereby obviating the difficulties arising from oxidation of contact points; by a special arrangement of the mechanism, residuary magnetism is impossible; in the striking clock the first blow of the hour will be given within a single beat of its pendulum to the true time; these clocks may be powerfully constructed, and used with either weight or spring, and with any length of pendulum; it will not be necessary to open the cases for any purpose but repairs; any person can wind them, thus dispensing with the clockmaker, except for repairs; and that the time indicated must be the true time: the last hour of setting will be shown on the dial. An extra dial, enclosed in the case, will record the rate of the pendulum's performance, as that is not disturbed in any way by the electric time setting, which is done by relieving the motion work from the train, and the regulation can be effected to a perfect average. This will give the synchronous clock a greater advantage than an ordinary clock, where the electric current is uncertain in its action. With regard to the cost of the clocks with Mr. Harrison's arrangements for ensuring synchronism as compared with those at present in use, the inventor states that the difference would be quite unimportant, the price of one of his synchronous clocks of the best construction, not exceeding that now paid for a good striking clock.

IMPROVED SYSTEM OF MOULDING WHEELS.—During the past three years the patent wheel-moulding machine, invented by Mr. G. L. SCOTT, has been in successful use among engineers and others, who derive great advantage from their employment, from the great economy which results, as compared with moulding from entire wood models. A trammel of any desired radius revolves around a central axis: at the end of the trammel is a vertical slide, to hold the segment of the wheel, capable of being raised and lowered: a dividing apparatus moves the trammel the required distances on the circumference, the whole being portable. It is claimed that this combination secures a true periphery, the mould of the tooth and space perfect in finish, the accurate relative position of the teeth, together producing the best possible wheels desired by the trade, with greater correctness and economy than by making patterns or cutting wheels by machinery.

IMPROVED PRESSURE GAUGES.—To remove the cause of complaint of inaccuracy, Messrs. KING and Co., of Manchester, have designed some improved mercurial and other pressure gauges, which appear to have given great satisfaction to all who have used them. In the improved mercurial gauge a glass tube is bent into a series of U's. The lower point of each U is filled with mercury, and the upper portion with glycerine. On the application of pressure at one end of the tube, the mercury is depressed in one of each pair of tubes and raised in the other; and the pressure will be equal to the summation of the lengths of the four columns of mercury, minus the weight of a corresponding length of glycerine. The tap affixed to the gauge is so constructed that no water or any impurities from the boiler can enter the tube, so that there is no liability to freeze or clog up. It is claimed that this gauge possesses the perfect accuracy of the single column of mercury, combined with some very important advantages. It is of a convenient size, occupying but little more room than the ordinary spring gauge. It is not affected by frost, does not corrode or clog up, and is not practically affected in any way by changes of temperature. It is permanently correct, and possesses the special advantage of being easily checked by measurement; a simple rule for which is attached to each gauge. On these grounds it is confidently recommended for all stationary and marine boilers where the working pressure does not exceed 70 or 80 lbs. per square inch; but as the size requires to be considerably increased for higher pressures, it is not so well suited for locomotive and portable engines, for which they consider the dead weight check gauge is better adapted—this is constructed upon the principle of Bourdon's gauge, with some important improvements, and possesses the very special advantage that its accuracy, when under pressure, can be tested at any time by dead weight, in a very simple manner—a brass cap is removed, and a weight attached to the gauge is hung to a small hook which projects from the tube on removal of the cap. If working correctly, the pointer will then fall to a corresponding figure on the check scale, and if working incorrectly the extent of error will be at once seen. The advantage of knowing when a gauge is working correctly can hardly be over-estimated; as, when the actual pressure is either below or above what is indicated, great loss is entailed in the one case, and serious risk in the other.

FIRE-PROOF FLOORING.—The method of constructing floors, according to the system patented by Messrs. R. MORELAND and SON, of Old-street, appears to offer many advantages. It consists in fixing wrought-iron girders at given distances apart on the walls of buildings, and then placing between them on their lower flanges a number of wrought-iron bow and string lattice girders, and on the upper or curved surfaces of these laying corrugated iron throughout the floor. Concrete or other material is then laid on the corrugated iron to the desired form and thickness, and sleepers, joists, and floor boards may then be laid on the concrete in the ordinary manner. The ceiling joists are notched, or otherwise fixed, on the lower part of the lattice girder, and then lathed and plastered in the usual way. The concrete thus laid on the corrugated iron forms a natural arch, and is prevented from exercising any lateral thrust by reason of the bow and string lattice girders with the corrugated iron acting as permanent centering to the arch. This combination is now proved by a variety of tests to be the best possible disposition of the various materials composing the floor, and the results are such that both great strength and economy are combined. This floor has now been practically tested both in supporting great weights and resisting impact from falling bodies, and this construction of floor is also found to give great facility in execution.

BOGIE CARRIAGE FOR BRANCH RAILWAYS.—That the introduction of cheap and light railways would be most desirable in many districts which do not offer sufficient inducements for the construction of ordinary railways is beyond question, and the success of the Festiniog line affords some idea of what may be done in this direction. The object of Messrs. FAIRLIE and SAMUEL'S patent is to facilitate working over such lines—the patent is now being introduced by the Railway Working Association. The weight of the steam-carriage with fuel and water for a 40-mile run does not exceed 14 tons, and there is accommodation for 90 passengers, weighing 6 tons. The steam bogie carriage has ample power to take one additional light carriage, specially constructed to accommodate 100 passengers, or two light carriages with 50 passengers in each, at an average speed of 30 miles per hour, up gradients not exceeding 1 in 60, and with a consumption of coke less than one-third of the ordinary passenger locomotives now in use. The maximum weight in the driving-wheels is reduced to 2½ tons per wheel, instead of 5 to 8 tons on a wheel as now ordinarily in use, thus effecting great economy in the maintenance of way, and wear and tear of rails. From the extreme length of wheel base, the steam-carriage will be remarkably steady at high speeds when running in the straight line; and by the arrangement of the double bogies, can pass round curves of the smallest radii now in use with great precision and steadiness, and at the termini can be turned slowly on a simi-circle of 60 ft. in diameter. For the purpose of repairs, auxiliary or supplementary wheels are provided, as shown, which may be lowered on to the rails when the steam-bogie is detached from the carriage, which can be done in a few minutes. It will be seen that the guard and engine-driver are in close communication, and a platform with hand-rail round the sides of the carriage, or, in the case of saloon carriage, a passage down the middle is provided to enable the former to communicate with the passengers when necessary while the train is in motion. This carriage is in itself a complete train in a condensed form. Its first cost will be little over one-third of an ordinary train of same capacity, while it possesses the important advantage of half the whole weight being made available for adhesion on the rails or tractive power. The invention would, probably, with slight modification be admirably adapted to passenger traffic upon suburban tramways.

FEED-WATER HEATER.—A very simple form of feed-water heater was exhibited by Mr. T. G. ELLIS, of Dorset-street, Salisbury-square. The advantages claimed for it are that it furnishes the boiler with a full and steady supply of thoroughly heated water, raised to the boiling point (212°) by means of the exhaust steam, without creating any back pressure on the engine. It keeps the boiler free from incrustation and sediment, as lime and all other impurities contained in the water that can form scale or sediment are separated from it and retained in the heater, leaving the water soft and pure as it enters the boiler. It is estimated it saves from 15 to 25 per cent. of fuel, and is considered to add materially to the safety and general economical working of the boiler.

With regard to some of the other inventions, the readers of the Journal have been so fully informed concerning them that it is scarcely necessary to repeat the details. The Wire Rope Tramway of Mr. C. Hodgson was described and commented upon in the Journal of Feb. 13, and we shall take the opportunity of again referring to it as soon as the line, which it is understood is being constructed by the Wire Rope Tramway Company for a mining company in the Alps, shall have been completed. The Safety-Lamp of Mr. S. P. Bidder, jun., is an ordinary lamp, with an improved locking arrangement. The invention is equally applicable to all kinds of lamp at present in use, the improvement consisting in unlocking by means of a powerful electro-magnet instead of with a key, the result being that it is absolutely impossible for the lamp to be tampered with by the colliers. One apparatus, the cost of which is about 5*l*., and the cost of maintenance 1*l*. per annum, suffices for an entire colliery, and such is the rapidity of its operation, that 300 lamps can be unlocked in the hour; they are all self-locking, and in this connection there is no peculiarity as compared with other lamps. Some other inventions will be referred to upon another occasion.

CAST-STEEL.—Mr. VICTOR GALLET, of Broom-parade, Ecclesall-road, Sheffield, in describing his improvements in the manufacture of cast-steel, says that for this purpose he takes iron ore, and mixes therewith the following composition:—Carbonate of lime, 37 parts; clay, 18; carbonate of potash, 20 to 24; oxide of manganese, 3; resin, 3; charcoal, 50; common salt, 1; water (about), 10. In place of char-

coal soot and lampblack may be used, and for carbonate of potash carbonate of soda may be used, either alone or with caustic potash, in the proportions of 20 parts carbonate of soda and 2 parts of caustic potash. If carbonate of soda be used alone the proportions should be from 20 to 30 parts. The ore, when mixed as above described, is melted in a furnace, and cast-steel results.

COPPER MINING IN ANCIENT TIMES.

In his interesting presidential address at the recent annual meeting of the Royal Institution of Cornwall, Mr. W. JORY HENWOOD gave a series of valuable particulars relating to the copper mining interests in ancient times. He raised the question—Were the old Cornish miners unaware of copper, when they had it?—by remarking that as of late years much has been written and said concerning the waste of copper ore by the miners towards the end of the seventeenth century and in the beginning of the eighteenth, it seems desirable to examine the evidence on which such statements are founded more closely than, perhaps, it may have been hitherto examined. Dr. Borlase, Dr. Pryce, Mr. William Phillips, and Mr. Warington W. Smyth are amongst the principal; but Mr. Carew, Mr. Hals, and Mr. Tonkin, are the earliest writers on copper mining in Cornwall. Dr. Borlase, writing in 1758, said that the yellow ore, which then sold for "between 10*l.* and 20*l.* per ton was, about 60 years earlier—namely, about 1698—called poder (that is dust), and thrown away as mundic." Dr. Pryce stated, in 1778, that "70 years previously—that is to say, in 1708—black copper ore was thrown into the rivers as refuse by the name of poder, which signifies dust, mundic, or waste." Mr. Phillips, in 1814, mentions it as "an undoubted fact that within a century many roads in the country were mended with copper ore." Mr. Smyth remarked, in 1852, that "at the commencement of the last century Redruthite (viteous copper) was thrown as worthless rubbish over the cliffs of Saint Just into the Atlantic." Thus Dr. Borlase states that yellow copper ore was thrown away, but is silent as to black and vitreous ore having been treated in the same manner; Dr. Pryce states that black copper ore was thrown away, but is silent as to yellow and vitreous ore having been treated in the same manner; and Mr. Smyth states that vitreous copper ore was thrown away, but is silent as to yellow and black ore having been treated in the same manner.

With regard to these statements Mr. Henwood contends that the testimony of each writer is worthless, and that each could only have repeated mere hearsay statements; because Dr. Borlase was only in his third year of age at the date he says yellow copper ore was wasted; Dr. Pryce was unborn at the date he says black copper ore was thrown away; and as Mr. Smyth is still in the prime of life, it is obvious that the rejection of vitreous copper, which he represents to have taken place at Saint Just early in the last century, must have occurred long before his birth. Moreover, Dr. Borlase, who was descended from a county family long established in the neighbourhood, who had been born at Saint Just, and who was for many years vicar of the parish, must have at this very time have lived on, or immediately near, the spot; yet he makes no mention of the circumstance. Thus each of these three authors represents a different ore (of copper) to have been wasted, but in all cases from the ignorance of the workmen. Mr. Wm. Phillips, a descendant from one of the families by whom, under the firm of Fox, Phillips, and Fox, an import trade was established at Perran Wharf, was born in London, in 1773, and died there in 1828. As his memoir "On the Veins of Cornwall," commenced in 1800 and published in 1814, mentions that in many parts of Cornwall copper ore had been used as road metal within a century, and as he died at the comparatively early age of 55, there seems little or no doubt that he must have referred to a period beyond his recollection, if not indeed before his birth. Furthermore, it must be remembered that all lodes partake, more or less, of the nature of the adjoining rocks; and thus consist in great measure of earthy minerals.

The ores of copper are, therefore, amongst the scarcer and softer; and for road-metal they are some of the least suitable ingredients of the lodes of Cornwall. From the foregoing comparison, it follows that if this alleged waste of copper ore took place it must have been when (the future Dr.) Borlase was still in his childhood, and whilst the other writers on the subject were as yet unborn.

And Mr. Henwood refers to the writings of Carew, who died in 1620; of Hals, who died in 1737; and of T. Tonkin, M.P., who died in 1742; to prove that the reverse was the fact. Mr. Carew observes that "copper is found in sundrie places, but with what gain to the searchers I have not been curious to enquire, nor they hastie to reveale. For at one mine (of which I tooke view) the oure was shipped to be refined in Wales, either to save cost in the fewell, or to conceale the profit." Mr. Hals remarks that "the waste lands of Blanchland, in Kea, is not only abounding in tin and tin mines, but for 20 years past hath yielded its owners about 20,000*l.* out of its copper mines, though the waste, or down, land in which it is found, is in many places scarce worth eighteen pence per acre." Mr. Tonkin states that "within these sixty years copper has turned to very great account in this country; and there have been very great discoveries made therein, both in the eastern and western parts of it, which have produced yellow (which is the most common and plentiful of any), green, blue, black, ash-colour (vitreous), and solid ore. This variety of ores, and great increase of the mines, has occasioned the setting-up of six several companies for buying of the ore." Mr. Henwood does not maintain that these conflicting statements of writers who could not have witnessed the matters they mention, and the silence of contemporary authorities, actually disprove the alleged waste; but they certainly throw such doubt on the allegation as to render further evidence necessary to establish it.

The question—When was the system of bottom stoping replaced by the present system of back stoping?—was discussed in an equally exhaustive manner. Having described the ancient mode of mining, as given by Dr. Pryce, in which stoping is said to be not unlike "the hewing a flight of steps in a rock, where each man works away the step above that which he stands on," and Mr. Carne's account of the same process "by driving levels and stoping upwards," Mr. Henwood went on to observe that the advantages of this latter system have been so long and so generally recognised that they need no recapitulation at present; therefore, it is intended merely to enquire where, when, and by whom it was introduced—an enquiry of, perhaps, no great practical value, yet one not without interest as regards the history of copper mining in Cornwall. The former mode of working was described by Dr. Borlase in 1758, and by Dr. Pryce in 1778. Their sections of the Pool (East Wheal Crofty) Mine, and of Bullen Garden (Dolcoath), represent the deepest parts to have been wrought underhand, but show no more than one—if, indeed, even a single back stope. When some time before 1775—as shown by an original copy of the prospectus, with a table of contents, in the author's handwriting, now in the Chairman's possession—Dr. Pryce's section was made the works were rather more than 90 fms. deep. In 1788, however, they had reached a depth of about 185 fms., when, the adventurers believing them to be no longer worth prosecution, they were abandoned. In 1800 operations were resumed, and it was then found that before the mine was relinquished in 1788, beside levels and winzes, *back stopes had already been opened*. This is the earliest record of the present system of working with which he was acquainted. But, whilst the mines of Cornwall were still wrought on the ancient system of underhand stopes, and before the works of Dr. Borlase and Dr. Pryce were even contemplated, the mines of Clausthal and Zellerfeld (in the Hartz), Hanover, and the works of Ilmenau, in Saxe Weimar, had not only been wrought by aid of shafts, levels, winzes, and back stopes, but had also been described by Brockmann and Tromler, as early as 1730. It has been shown that the ancient system prevailed as late as 1755-8, but that the present mode, which had been adopted and described in Germany in 1730, was followed at Dolcoath before 1788. Mr. Rudolph Erich Raspe, who was born at Hanover, in 1737, published several scientific works in various languages, and became successively librarian, professor, and curator of the Museum of Antiquities and Coins at Cassel, having been compelled to leave his country, was employed as assay master and storekeeper at Dolcoath from 1782 or 1783 to 1786, if not, indeed, until the mine was abandoned, in 1788. This evidence—circumstantial rather than positive—seems to show that the mode of working which had been practised in Hanover and Hesse more than 30 years earlier was unknown in Dolcoath in 1778; that it was adopted in Dolcoath in 1788; and that during 1782-3—6, at least a portion of the interval, Mr. Raspe, an eminent literary and scientific Hanoverian, was employed on the spot.

Nor is the copper precipitating process in its application on the large scale in Cornwall so new as some have been inclined to suppose. Mr. Henwood observes that the precipitation of copper from the salts contained in mine-water—observed at Chacewater (Wheal Busy) Mine, by Mr. Coster, about 150 years ago, and made subject to experiment at Wheal Crofty shortly afterwards, seems to have been lost sight of (save in a very few instances) in Cornwall until within some 12 or 15 years since. Within a short time after Mr. Coster's discovery at the Chacewater Mine, however, several workmen migrated from that neighbourhood to the county of Wicklow, where they obtained employment at the Cronebane Mine, which was then superintended by Capt. Thos. Butler, a native of Redruth. At his suggestion the precipitation works were established which, with gradually diminishing produce, have been carried on there from that time to this. When the enormous deposit of copper ore was discovered at the Parys Mountain, in Anglesea, a century since, and the water percolating through it was found to be richly charged with sulphate of copper, similar proceedings, but on a much larger scale, were adopted. Thence the system was taken to Cuba by Mr. Treweek, of Mawnan. It is a remarkable, perhaps a characteristic, circumstance that, notwithstanding the great adit—commenced in 1748 by Mr. Williams, of Burncoose, great-grandfather of Sir William Williams, Bart.—had been extended before the commencement of the present century to most of the principal mines in the Gwennap district, as well as to the very Chacewater Mine in which Mr. Coster had so long previously observed the progress of precipitation, it was not until some 15 years ago that attempts, successful attempts at least, were made to precipitate the copper held in solution by the adit water. About 1854, however, a person, who had gained some experience in the works of Cuba, commenced operations on the stream. The success of his experiment stimulated his neighbours, and in the course of eight or ten years at least a dozen other parties had set themselves to work on its bank, between the mouth of the adit, near Ferny-splat, and the tide at Tarnon-dean—a distance, perhaps, of a mile and a quarter. The quantity of water discharged by the adit averages about 1450 cubic feet (8800 gallons) per minute; the quantity of saline matter contained in it averages about 735 grains ($1\frac{3}{4}$ ounce) per cubic foot; the quantity of precipitate collected for some time past has ranged from 80 to 100, and averaged, perhaps, 90 tons a year. The proportion of fine copper contained in the precipitate varies from about $6\frac{1}{4}$ to $61\frac{1}{4}$, and averages nearly 40 per cent. Thus, 423 parts of precipitate, containing 165 parts of fine copper, are, on an average, extracted from 100,000,000 parts of water; in other words, 3784 cubic feet, or about 175 tons of water, yield 1 lb. of precipitate, or 4693 cubic feet, or about 270 tons of water, yield 1 lb. of fine copper. The capacity of the Truro Council Room is about 24,000 cubic feet. A volume of the adit water, of the same dimensions and average richness, would, therefore, afford about $2\frac{1}{2}$ lbs. of fine copper. Before the establishment of precipitation works, therefore, the adit water had already carried with it in solution into the sea at Restronguet from 150,000*l.* to 200,000*l.* worth of copper.

THE SMOKE NUISANCE, AND LIQUID FUEL.

Although it has now been pretty well ascertained that with suitable arrangements and the exercise of proper care smoke can be prevented whatever description of fuel is used, it is acknowledged that the difficulties of avoiding the smoke nuisance varies materially even with coals from the same district; so that any attempt to lay down a general principle which under ordinary circumstances can be depended upon is worthy of careful consideration. A highly interesting little pamphlet has just been published (through Messrs. Atchley and Co., of Great Russell-street) by Mr. C. J. RICHARDSON, whose name is already well known to the readers of the Journal as the inventor of an improved method of burning petroleum and other hydrocarbon oils, entitled "The Smoke Nuisance, and its Remedy by means of Water; with remarks on Liquid Fuel." Mr. Richardson's remedy is to pass smoke through a water spray. A few years ago he had an experimental stove and flue erected to try the effect of water upon smoke, and becoming interested in the matter, on the success of his trial he sought to ascertain what had previously been done in the matter. He found that the idea was not new, but that no information was given as to the way in which the contrivances which had been proposed operated.

It appears that the first patent granted for this system of smoke prevention was that to Mr. Chaplin, in 1852; it was for subjecting smoke in chimney flues to the purifying action of water.

According to this invention, jets or showers of water were made to play within the chimney, or in a chamber connected with it; the smoke or vapour passed through the water, by which it was condensed, and all the heavy matters and impurities were carried off through passages fitted to receive and retain them. This patent was, however, only a repetition of one granted 38 years previously, to the well-known Frederick Muntz, of Birmingham, who described his method as one for nearly destroying smoke, and obtaining a valuable product therefrom. Mr. Muntz passed the smoke through a quantity of water, either cold or warm, before it escaped into the atmosphere; and by that means, all the blacks and earthy substances contained in the smoke were thrown down and precipitated, or swam on the surface of the water, and were collected as it ran away. He gave a general description, so as to include every possible way in which it might be done. He preferred an horizontal flue, with a copper top perforated with holes, the top constantly covered with water 2 or 3 in. deep. He said the same effect may be produced by jets of water from the bottom or side of the flue, or in any other way by which the water shall pass through the smoke. He preferred the shower-bath method, and suggested air-pumps, air dips or ventilators, and bellows, to create a draught. How the construction of all this, or any part of it, was to be carried out, was not shown—no drawing of any kind was given, either by Mr. Muntz or Mr. Chaplin, and the patents were useless.

The advantages attending the use of the Cubitt, or descending, flue is referred to, to prove that zinc tubing, cowls, &c., are not absolutely necessary to prevent smoke; but Mr. Richardson appreciates the fact that existing flues of other construction will probably have to be dealt with, and very truly observes that some of the finest specimens of architecture in the metropolis serve only as pedestals to an ugly collection of cowls. To obviate this difficulty—

He proposes to form the upper part of the flues in a building, for a length of about 15 to 20 ft., entirely of iron or other tubing, in square, round, or oblong sections—of course, of a less diameter than the brick flues to which they are attached. This tubing is gathered up in groups, and carried at an angle of 45° towards a centre stack: the tubes in direct contact with each other, having no brick wyths, except one or two to strengthen the stack. It is obvious that if only one of the flues be in use it would warm moderately those next to it; and if the whole of the flues of a building were to be constructed on this plan, and two or three in use, such a power would be obtained as would effectually ventilate every room, and a fire could be lighted in any one without the risk of return smoke from a cold or damp flue. Thus, the heat now wasted in the atmosphere by the action of the common flue would be partly kept and turned to use, and the draught of the flue very much improved. This tubing the writer calls stack flues; they could be readily introduced to either old or new mansions, as their introduction does not involve the taking down of more than 12 ft. of the brickwork, measuring from the top of the coping. The tubes could never become sufficiently heated to be dangerous, and less brickwork would be required.

Mr. Richardson maintains that by a proper construction of these stack flues any amount of ventilating power, self-acting and continuous, could be obtained; that some command would be possessed over the smoke; and that the roofs of our buildings might be made ornamental and picturesque.

The latter part of the pamphlet is devoted to the consideration of liquid fuel, Mr. Richardson remarking that the working of it, now that it is found out, appears a very simple process. An evaporation of from 16 lbs. to 20 lbs. of water from 212° Fahr. per 1 lb. of oil, without producing a high temperature in the furnace-room, can now be obtained for any length of time without ceasing—the fire as easily managed as the light of a gaselier. Mr. Richardson says—

The best steam coal in real practice produces an evaporation only of from 6 to 7 lbs. of water from 112° Fahr. per 1 lb. of coal; with a high temperature in the furnace-room, that at 140° always tells its tale in the consumption of fuel, careful stoking does not take place, and it is not in human nature that it should. The oil in stowage requires 60 per cent. only of the space allowed for coal, so the great gain and the greater economy by the use of the oil, when it is treated properly, becomes apparent. The cheapest and strongest oil-fuel is the refuse of the shale-oil distillers. Every ton of shale crude-oil on refining leaves a large percentage of this; let a market be found for it, the manufacture of the clear-burning oil would become one of the largest and most important pursuits of Great Britain. The natural oils can be used for fuels, but the explosive spirit should be first extracted from them; this can be done by a blast of steam being sent through them. The amount of shale in England and Scotland is so vast, it is said to be inexhaustible. Some of the richest specimens of the different varieties of albertite, cannelite, &c., produce 115 to 150 gallons of crude oil to the ton, but the average amount yielded by the common shale is from 30 to 40 gallons. Immense fields, or rather regions, exist of it both in Canada and Australia—plenty of labour and plenty of cheap material for the future generations of men. Creosote, which can be obtained at present at a very low price, makes as strong fuel as the best oil; so does naphthaline, still cheaper than creosote. But the latter would not give 1 per cent. of the amount required for sea service, and the napthaline only a small fraction.

Mr. Richardson considers that the present great expense of steam navigation throughout the world is owing to the bulky character of the fuel; in the great ocean steamers it forms 85 per cent. of the whole working expenses. It prevents any large amount of paying freight being taken.

From the variety of subjects treated of, and the vast amount of information condensed into the pamphlet, it will well repay perusal.

THE MINING ATLAS.

Mr. Spargo has in the present work* excelled all his other publications, by the importance of the subjects and the exceedingly interesting manner in which they are treated. No fairy tale could contain a more romantic air, or be written in a more graceful style, than the Mining Atlas. So varied is the geological, mineralogical, topographical, and geographical information and description that the work is a repertory of scientific information, associated with scenes and incidents, local and historical, of thrilling interest. The book is designed to convey accurate and complete information concerning the chief metalliferous districts in the British Isles and America. To this end no less than 50 maps of mining districts and territories, and sections of the most remarkable and productive mines, compose the Atlas.

The original intention of the author was to issue it in two volumes, but yielding to the importunities of his friends, and the convenience of the public, it is published in numbers, of which there will be 10, at 1s. each. The first number has just appeared, and we cannot avoid the expression of our astonishment that it could be sold for 1s.

There are the following features of the Atlas:—1. A map of the United States and territories, brought down to the end of 1867.—2. Map of section of the main lode of the celebrated Dolcoath Mine.—3. Transverse section of Great Dolcoath Mine, with a letter press description of the lodes.—4. Botallack Mine, longitudinal section.—5. Transverse section of the principal mining district of Cardiganshire.—6. Map of Colorado territory, United States. All the maps and sections are beautifully executed, but that of Colorado territory is a surpassing beautiful specimen of orographical delineation.—7. Longitudinal section of the main lode in Tresavean Mine, Gwennap, Cornwall.

The maps of this one number are worth considerably more than double the price of the whole 10 numbers.

The letter-press is on first-class paper, large, clear type, and in every respect well finished.

The literary portion of this number is varied and excellent. Chapter I. is introductory and general; chapter II., how mines are worked, and plans and sections are framed; chapter III., general descriptions of the mining regions in Great Britian, of which maps and plans are given in the volume, such as Cornwall and Devon, Cardiganshire, and the Isle of Man; chapter IV., mineral-bearing regions of the American continent, Cardiganshire, Dolcoath Mine, and Botallack Mine. There are 36 quarto pages of literary description and original treatise on the important subjects above named. We strongly recommend not only persons engaged in mining as investors or otherwise, but the whole public to make the opportunity available of procuring what we do not hesitate to pronounce one of the most interesting works given to the public for many years.

* "The Mining Atlas." By THOMAS SPARGO, M.E., &c. Published by the author, at 224 and 225, Gresham House, Old Broad-street, City.

GEOLOGICAL CHIPS AND CHAPTERS.

The continually increasing demand from all classes of the community for scientific knowledge has given quite an impetus to the production of popular manuals, from which the required amount of information can be obtained without the necessity of systematic study. One of the latest works of this description is Dr. PAGE'S Chips and Chapters,* in commendation of which it is unnecessary to say more than that it is as interesting and instructive as any of his previously published works. The author very truly observes that the worker in any department of science, if he keeps abreast with its progress, has usually some discovery to announce, some paper to read, or some address to deliver, and it is from the miscellaneous matter thus brought together that such portions have been selected for the present volume as seemed calculated to convey a fair outline of the Principles of Geology to those who read it. Before any large amount of interest can be taken in the study of a science, the student must learn something of its aims and objects, and, well knowing that, Dr. Page devotes his first chapter to explaining the aims and objects of Geology. He observes that the science has much more to do than merely describe the rocks and minerals that compose the stony crust. To study the rocks and the history they contain from the most recent and superficial to the oldest and deepest we can reach is the prime aim of geology, and the more thorough our knowledge of existing conditions and operations, the more perfect will be the interpretation. In other words, the more we know of the physical geography of the present day, of the forces that act, and results they produce, of the plants and animals that live, and the mode in which they are entombed in the rocks, the better will we be enabled to infer from our examination of the old rocks the mode in which they were formed, the distribution of sea and land at the time of their formation, and the conditions under which their embedded plants and animals existed.

The aim of geology is, therefore, to read through its rocks and fossils the history of the earth's crust, and the changes it has undergone, and the aim of Dr. Page is to explain the way in which the language of geology is read. It will be found that ancient changes and ancient rock formations are far less evident, and of much more difficult interpretation, than those of recent date, and that this difficulty goes on increasing as we descend into the earth's crust, until we reach a stage when everything becomes obscure, and all the rocks are converted into homogeneous, or all but homogeneous, crystalline masses. The scope of geology, as a science of observation and deduction, is restricted, therefore, to the stratified and accessible crust. In this built up, modified, and remodified a thousand times by the forces now operating around us, we can trace a long and wonderful history of physical and vital mutation, and it is to the perfection of this history in all that has reference to geographical aspect, operative cause, and vital progress, that the modern geologist directs his attention. It is of paramount importance, then, that in geology, as in other departments of science, the student should thoroughly understand the scope and aim of his subject, concentrating his energies on what seems fairly attainable, rather than dissipating his thought on what belongs to another theme, if, indeed, it be not altogether unapproachable. Under the operation of certain forces we see this world of ours undergoing incessant change, and each change marked by its own peculiar rocks and their relations; and believing in the fixed and enduring nature of these forces, we seek to discover the changes it has undergone in time past by examining the rock formations of the crust; or, by reversing the order, we try from the earliest traces of change in the rocky crust to read the history of the earth, onwards and upwards to the changes now going on, and the rocks that are now forming around us.

Having thoroughly explained what may be expected from geological study, Dr. Page proceeds to consider the practical bearings of geology, the nature of geological evidence, uniformity and progression, and the present aspects of geological enquiry. These, with chapters on geology as a branch of general education, and on geology and modern thought, prepare the reader for the consideration of the chapter entitled "Rocks, their formation and metamorphoses," wherein the more technical portion of the subject is first referred to; and here it is that the reader begines to feel that he is really making some progress in the study of the science. The examples given in this and the succeeding chapters, by way of illustration, are taken almost entirely from Scotland, which will make the work especially attractive and valuable to field geologists who intend to take their summer or autumn excursions in that country. In discussing the place in education which the natural sciences should occupy, Dr. Page attaches less importance to classical studies than most persons would be incline to give them; but probably he has expressed his views rather strongly, not so much to induce less attention to classics as to impress upon all the very great importance of the natural sciences, and the advantage of careful observation and research whenever the opportunity occurs for practising them. In subsequent chapters of the volume, Dr. Page discusses, in a most able manner, the place in geology of Dura Den; rain-prints, sun-cracks, &c.; raised beaches and submarine forests; species making and nomenclature; and the characteristics and causes of scenery; concluding with "a forgotten chapter" (which alone is worth the price of the entire book), from Vertegan's "Restitution of Decayed Intelligence in Antiquities concerning the most noble and renowned English Nation," which, although published in 1605, displays an acquaintance with some of the leading principles of geology and of geological research, of which many even at the present day might well be proud.

Without attaching too much importance to the technical education mania, or admitting that we are at all behind the nations on the Continent in connection with that kind of knowledge which is necessary to the progress of our national industries, Dr. Page thoroughly recognises the fact that to retain the position we have hitherto occupied, it is necessary still to possess knowledge in advance of all others; and keeping this in view, he has sought to lay such a groundwork as may be thoroughly relied upon hereafter; for this reason his book may be profitably studied by all classes.

* "Chips and Chapters: a Book for Amateur and Young Geologists." By DAVID PAGE, LL.D., F.R.S.E., &c. Edinburgh and London: William Blackwood and Sons.

ENORMOUS BLAST.—Messrs. Richie and Jackson, who have recently become possessed of the quarries of Scrabo, near Newtownards, resolved to try a system of rock-blasting by means of a tunnel and a plan of igniting the powder by electricity. The *modus operandi* is somewhat as follows:—A tunnel or mine was driven in about 40 or 50 feet from the face of the rock to be blasted, this rock being from 70 to 80 feet high. In this tunnel a lodgment was made of several hundred pounds of gunpowder. Mr. Cumin, Belfast, to try the effect of firing gunpowder by magnetism, arranged the two conducting wires in the centre of the charge, connected by a very thin piece of iron wire. The battery was placed at about 100 yards from the rock; and shortly being charged, a large

mass of rock, estimated at from 8000 to 12,000 tons weight, was dislodged from its bed. Instead, however, as is usually the case in quarry-blasting, of having been sent flying in comparatively small pieces through the air, the whole mass was raised only a few feet, as we are informed, and opened in all it natural beds and joints, without in the least affecting the useful quality of the stone, or fracturing it in any way.

SHAFT SINKING THROUGH WATER-BEARING STRATA.

The present method of sinking shafts and tubbing is, when great volumes of water have to be contended with, exceedingly expensive and dangerous for the life of the workmen. It is expensive, from the great outlay for machinery and fuel necessary for pumping, amounting in some cases to more than 50*l.* a-day, and from the fact of the workmen having to do their work more or less whilst standing in the water. It is dangerous, as proved by many serious accidents, arising from the giving way of the tubbing, and from breakages in the pumping machinery, which is suspended above the workmen. At a certain depth it is almost impossible, with the old system, to make the tubbing tight and strong enough to withstand a pressure rising very often to more than fifteen atmospheres. A number of shafts, sunk at considerable expense, have been entirely lost from the giving way of the tubbing. Besides, repairs are often required, whereas in shafts made by Chaudron's system leakages and repairs are entirely done away with. Availing himself of this fact, Mr. HENRY SIMON, of Manchester, is now exerting himself to introduce the Kind-Chaudron system of sinking shafts, which has already been extensively tried in Belgium, France, and Prussia, and given the utmost satisfaction; it received, moreover, at the recent International Exhibition, at Paris, the only "grand prix" (the highest honour awarded) given to Belgium, so that no question can be raised as to the value of the invention. The principal features of the system are that an iron tubbing is used, made by preference of cast-iron rings, cast in one piece, lowered from the surface gradually, and superimposed one above the other as the work proceeds, a complete water-tight joint between these rings being obtained by the interposition of a thin layer of lead; and that a stuffing-box is employed for securing an infallibly water-tight junction with the underlying stratum. The boring tools employed have mostly a weight varying from 2 tons for the smaller borings of (say) 4 ft. diameter to 10 tons for the larger tools for a hole of 13 ft. to 14 ft. diameter. At the mines of the Société de l'Escarpelle two shafts are being sunk, and are open to inspection; but, as no details as to dimensions, &c., are given, it would be useless to state the expenditure upon them. At the Mines de l'Hôpital it is stated that two shafts were sunk on the new system for 35,000*l.*, the diameters being 8 ft. and 13 ft. respectively, and the depth 525 feet. The time occupied was rather less than two years and a half.

In sinking on the Kind-Chaudron system a boring is first made through the strata, which is effected by means of one or more boring tools, having a number of teeth or chisels, which act upon the "Chinese" system, the tool, after being lifted up by suitable apparatus for a height of about 1 or 2 ft., falling down and crushing the rock. These tools are of a width corresponding with the diameter of the boring to be made, and when the boring is of a large diameter, a small central boring is first made with a small tool, having a number of chisels all along its under surface, and sometimes also one or more other chisels on the ends of the cross-bar, fixed higher up on the rod of the tool, which serve to smooth off the side surface of the boring made by the lower chisels. After this, the boring is enlarged by means of one or more larger and heavier tools in succession, having a number of chisels at each end, and a projection in the middle, which passes into the central boring previously formed by the smaller tool, and which serves as a guide. Cross-bars, acting as guides, are also fixed upon the rods of the tools. The boring with the tools of the smaller diameter is, however, always kept so much in advance of the larger boring that the debris from the latter shall always fall into the former, and for this purpose the teeth of the enlarging tools are, by preference, arranged on an incline, so as to produce a boring, being connected to the smaller boring by an inverted cone. In the smaller boring may be suspended a metal receptacle, into which the debris fall, and which is withdrawn when full; or, as the work proceeds, the clearing of the debris may be effected as usual by means of an open metal cylinder, closed at the bottom by valves opening inwards, so that by working such cylinder up and down at the bottom of the boring the debris are made to enter the same, and are then raised to the surface.

The principal advantages claimed for the new system, as applied to the sinking of shafts through aqueous upper strata, are the complete isolation of such strata, the strength of the cast-iron lining, and the possibility of making water-tight joints therein, economy in money and time, less arduous labour for workmen, and the possibility of passing through all aqueous strata, no matter what their nature and thickness may be. It is stated that even when it is required to pass through a thick stratum of quicksand the new system offers great advantages as compared with those now employed, the mode of operating being varied to suit circumstances. If the strata above the quicksand be of sufficient consistency to prevent any serious falling in during the boring, the shaft is first sunk down to the quicksand, and a preliminary cast or wrought iron tube is then sunk down the boring, and is made to penetrate through the quicksand, and for some yards into the hard strata below; after this the shaft is sunk a few yards further, in order to prepare a seat for the bottom of the lining, and this latter is then lowered and rendered water-tight by the before-described process. If the strata above the quicksand be not of a firm nature, but yet sufficiently so to allow of being bored, a preliminary lining is sunk down to the quicksand, after which the before-mentioned tube is sunk through the sand, and the operation of lowering the lining is then proceeded with as before described. In both the above cases the lowering of the tube through the quicksand is the most difficult operation. If this tube be made equal in length to the entire thickness of the aqueous and overlying strata, so that it can be worked from the top, the operation will be facilitated, but the lowering of the tube might be difficult, on account of its weight. If, on the other hand, the tube is only made of a length equal to the thickness of the stratum of quicksand, it might be lowered by the ordinary apparatus by which the cylindrical lining is lowered, but in this case the penetration of the tube into the quicksand could not be so easily effected. It is, therefore, preferable to make the tube of the entire height, as before mentioned, as it is always possible to counteract any excessive weight by the application of a temporary equilibrium diaphragm in the tube, similar to that described with reference to the cylindrical cast-iron lining, and which is subsequently removed. When the weight of the tube is not sufficient to cause it to penetrate through the sand, various means may be employed to increase it; thus, it may be pressed down by means of screws or hydraulic presses, or the tube may be filled with water to a greater height than the level of the water in the boring, so that the water, besides helping by its weight, may, in escaping at the lower edge of the tube, owing to the decreased height inside it, decrease the friction of the tube in passing through the strata. As soon as the invention has been practically tested in this country a more detailed description of it will be published.

COAL IN THE ROCKY MOUNTAINS.—The Union Pacific Railway is not likely, as was at first anticipated, to suffer any inconvenience from the absence of steam fuel. A coal field, almost unlimited in extent, showing outcroppings for 300 miles on the road, has been "struck" in Wyoming territory, in the heart of the Rocky Mountains. The locomotives are now fed almost entirely by coal, worked by the company itself or by contractors, who furnish it at a low price. All the coal for 15 miles in the "alternate sections" on either side of the line is owned by the company. There are six mines in working order—there are others in progress. The principal mine, at Carbon Station, yielded 4000 tons to the railway company in the first three weeks in April. One of the drifts is already 540 ft. in length, and there is an excellent shaft, with the usual gear, pumps, &c., worked by steam-power. The thickest part of the seam so far opened is 9 ft. high. Hitherto neither fire nor choke damp has troubled the miners, but there is a certain amount of water in the deepest part. The miners are at present earning from $7 to $12 per day. The coal is of good quality. There is neither bitumen nor sulphur in it. It contains, by analysis, nearly 60 per cent. of carbon, 12 per cent. of water, and 26 per cent. of inflammable gases. It is to bear a new name, one which is perhaps tolerably appropriate. It is to be called "anthra-lignite," and as coal has been sold lately in Omoha, on the Missouri, at the rate of 4*l.* 5s. 6d. a ton, whilst the company will probably sell it at half that price, it will be seen that the discovery is one of the greatest importance to the whole central portion of the continent. Iron ores have been found near it, and a good collection of coal fossils has been collected at the Carbon Station. A coal seam has also been recently discovered at Elko, on the Central Pacific Railway, which is the continuation of the Union Pacific line already referred to.

FOREIGN MINING AND METALLURGY.

No material change can be reported in the Belgian coal trade. A certain activity has prevailed, however, at some workings, it being deemed advisable to expedite deliveries in consequence of the approaching closing of navigations. Coke has been in more demand in the Central district, and has been held with considerable firmness at 13s. 3d. per ton. Some contracts have been renewed, but in many cases negociations have been only slowly pursued, purchasers not having yet abandoned the indecision which has characterised them for some time past. With regard to the railway iron trade, it may be observed that the new affairs which have been in course of negociation of late have not yet been carried through. It should be again remarked, however, that the Belgian works can afford to wait, while it is impossible for them to contract for deliveries to be made this year. The general state of the Belgian iron trade has not experienced any change during the last few days; small current orders for iron of every description continue to arrive at the works, and prices are maintained with much firmness in all the groups, as well for plates as for merchants' iron. The report of the Charleroi Chamber of Commerce for 1868 has just appeared, and from this document we extract the following statistical data with respect to the production of pig in the Charleroi metallurgical group during the last three years:—

	1866.	1867.	1868.
Works	16	13	13
Blast-furnaces in blast	28	24	22
,, out of blast	12	15	16
Number of workpeople	2,648	2,224	2,300
Production ....Tons	286,000	256,000	265,580

We next pass on to the operations of the foundries of the district during the three years. The totals stand thus:—

	1866.	1867.	1868.
Establishments active	42	41	36
Steam-engines	39	39	36
Horse-power	287	308	296
Number of workpeople	982	847	826
Production ....Tons	23,729	17,466	16,225

We next come to the rolling-mills, which exhibit the annexed results:—

	1866.	1867.	1868.
Works	25	25	21
Puddling furnaces	313	302	297
Re-heating furnaces	134	143	137
Steam-engines	139	161	169
Horse-power	4,874	5,178	5,477
Hydraulic wheels	44	42	42
Horse-power	582	582	582
Number of workpeople	5,360	5,120	5,346
Production ....Tons	243,850	193,919	180,746

Finally, the establishments for working iron seem to have moved on as follows during the three years:—

	1866.	1867.	1868.
Works	20	19	24
Number of workpeople	194	167	156
Production ....Tons	2,805	2,371	2,322

The value of the pig and castings made in the Charleroi group last year was 1,171,636*l.*, as compared with 914,754*l.* in 1867, and 1,048,950*l.* in 1866. Iron was made in the group last year to the value of 1,437,978*l.*, as compared with 1,368,812*l.* in 1867, and 1,724,108*l.* in 1866. The house of Dorlodot Brothers, of Acoz, has concluded a contract to supply 10,000 tons of rails to M. Armand Bouqueé, of St. Petersburg. The North of Charleroi Colliery Company is paying a dividend at the rate of 12s. per share for 1868. The Bonne Esperance Collieries Company is paying a dividend at the rate of 1*l.* per share for 1868. The Sambre and Meuse Mines and Ironworks Company is paying a dividend at the rate of 12s. per share for 1868.

Some important provincial orders continue to come to hand in the Haute-Marne, and the demand for iron has become very active. Coke-made is quoted at 2*l.* 17s. 6d. to 2*l.* 18s. 4d. per ton, mixed pig at 3*l.* 8s. to 3*l.* 9s. 8d. per ton, and charcoal-made pig at 4*l.* 1s. 8d. to 4*l.* 4s. per ton. Rolled iron from mixed pig has brought 9*l.* to 9*l.* 8s. per ton, according to the producing works, while rolled iron from coke-made pig has realised 8*l.* 4s. to 8*l.* 8s. per ton. Hammered iron has made 9*l.* 12s. to 10*l.* per ton; axles, 10*l.* to 10s. 4s.; puddled charcoal-made machine iron, 9*l.* 16s. to 10*l.*; mixed ditto, 9*l.* 8s. to 9*l.* 12s.; and coke-made ditto, 8*l.* 8s. to 8*l.* 12s. per ton. The Champagne Committee of Forgemasters has been negociating with the Eastern of France Railway Company with reference to certain reductions of tariff, but has failed to make any impression upon the railway board. Nothing daunted, the Committee of Forgemasters has prepared a petition to the Emperor on the subject. The bad impression produced in the minds of the members of the committee by the refusal of the railway company to meet their views has been, it may be added, effaced to some extent by a communication as to a scheme for carrying out a canal to unite directly the canals from St. Quentin and from the Sambre to that from the Aisne and the Marne. It is affirmed that the canal would prove highly advantageous not only to the metallurgical district of the Haute-Marne, but also to the whole industrial group of the Meuse, the Moselle, and the coal trade. Iron has been in active demand in the Ardennes. The refining pig of the district has become scarce, and as pig is in increased demand the local iron trade is availing itself of English pig. At Paris the rise in iron has become more and more decided, not only as regards iron for building purposes, but also as regards coke-made merchants' iron. Pig is beginning to revive from the torpor which it has long displayed in France, and a substantial advance in prices appears now imminent. The Naval and Railway Blast-Furnaces, Forges, and Steel Works Company will pay, May 31, the balance of the dividend for 1867-8; this balance is 1*l.* per share. The Bethune Mines Company is now paying the balance of the dividend for 1868, or 10s. per share.

The French copper markets have been heavy, and have displayed a decidedly downward tendency. At Havre there are few transactions to note; at Paris, also, the condition of affairs has remained rather difficult; Chilian in bars is quoted at 70*l.*, Chilian in ingots at 74*l.*, and Corocoro minerals (pure copper) at 74*l.* per ton. On the German markets the article has been comparatively neglected. The Dutch markets show little or no change. Business in tin at Amsterdam presents little change; consumers have only purchased to meet their absolute requirements. At Rotterdam business in tin has also been comparatively limited; some hundred ingots of Banca have changed hands at 80 fls. There is no material change to report in lead. At Paris rough Silesian zinc has brought 21*l.* 8s., and zinc from other sources 21*l.* 12s. The German zinc markets have shown a slightly downward tendency.

The Vieille Montagne Zinc Mines and Foundries Company has just held its annual meeting at Angleur, near Liége. Notwithstanding a fall of about 16s. per ton in the price of zinc in 1868, last year terminated with profits nearly equal to those of the preceding year, and no alteration took place in the dividend rate for 1868, as compared with that which prevailed for 1867. It is not altogether certain, however, that the future of the company will be so satisfactory as its past has been, in consequence of the great development assumed by the production of zinc, by reason of the important discoveries of minerals made in Sardinia during the last two years. This new production of minerals, which promises to become more considerable every year, not only assures the supply of a part of the previously existing zinc foundries, but also appears likely to encourage the establishment of new reduction-works in England and France. The operations of the Vieille Montagne Company for 1868 may be summed up as follows:—97,026 tons of rough minerals of every kind, extracted from mines in Belgium, Prussia, and Sweden; 75,978 tons of zinc minerals, submitted to calcination and roasting; 3592 tons of argentiferous galena, carbonates of lead, and pyrites, obtained in various mechanical preparations; 89,816 tons of coal extracted from two collieries which the company owns in Belgium; 40,219 tons of rough zinc, produced in seven reduction-works; 24,975 tons of zinc, rolled in various rolling-mills; 5418 tons of zinc-white, manufactured; and finally, 39,367 tons of various zinc and zinc-white sold in various countries, producing, when added to the sales of lead minerals, coal, and accessory products, nearly 920,000*l.* The net profits of 1868 were 111,535*l.*; of this sum 30,399*l.* was absorbed in various statutory and other reductions, 81,000*l.* was paid away in a dividend at the rate of 14s. 6d. per tenth share, and 136*l.* was carried forward to the credit of 1869. The directors have been authorised to purchase certain properties, the acquisition of which is deemed essential to the further development of the undertaking.

The Emperor Napoleon, on hearing of the catastrophe at the coal pits of Firming, where 15 persons lost their lives, sent off 160*l.* as a first contribution, to be distributed amongst the families of the victims.

NEVADA LAND AND MINING COMPANY.—The following extract, relating to the property of this company at Reno, Nevada, United States, is taken from the Reno Crescent of May 1:—"The Auburn Mill, adjoining Reno, is owned by an English company, known as the Nevada Land and Mining Company. The mill, which is of 20 stamps, with a complement of pans and settlers, was completed in 1865, the calculation then being to work ores from mines in the neighbourhood until the completion of the railroad to Humboldt, where the company own some extensive mines, containing much more valuable ore than any in this region. On making a trial it was found the ores here would not pay, and the mill shut down. Last September the present manager, Mr. J. J. Dunne, arrived here from London, and immediately commenced putting the works in order. Very extensive repairs have been made, including the cleansing of the ditch from end to end, and the digging of a new tail race seven miles in length. The mill power is one of the very best in the State or on the coast. The capacity of the ditch is, we believe, something over 5000 inches of water. The wheel at the mill is an overshot, 32 feet in diameter, with 18 feet breast, equal to about 150 horse power; it is a beautiful piece of mechanism. Indeed, while there are many larger mills in the State than the Auburn, there is not one so complete in its structure and appointments as this. The mill started up on Tuesday last on ore from the Alpha Mine of Humboldt County, and it is expected that within 30 days the mill will be constantly running to its full capacity. The present working is by the ordinary wet process, but Mr. Dunne contemplates, during the coming summer, the erection of roasting furnaces, to work the richer grades of Humboldt ore, which are now being shipped to Swansea, South Wales. With the immense water-power of the Truckee, and cheap transportation of ores promised by the railroad company, there is no reason why the rich Humboldt ores, for 10 miles on either side of the railroad, should not be brought here for reduction; and when we consider that the road passes for 300 miles through a region destitute of timber, but abounding in rich mines, some idea can be formed of the future which certainly awaits this section of the State. The Nevada Company propose to erect other mills, and to furnish milling power to any desired capacity. Mr. Dunne informs us that he has had applications for crushing, sufficient to run to full capacity, as soon as he builds his contemplated furnaces. This company also own an extensive body of land surrounding the mill, about 800 acres of which is under fence, and over 300 of which is this season planted to grain and seeded to grass and clover. This English enterprise was started in 1863, and upwards of $600,000 has been expended in the acquisition of property and the improvements connected therewith. The company exhibit in a high degree the bull-dog tenacity so characteristic of their country, and it cannot but be hoped that under the improved aspect of the country generally, and the internal developments being made, they will soon reap the harvest their enterprise and pluck entitle them to. They have a splendid property; and when everything gets working at the mill, as it will be in another month, Auburn will be the prettiest spot in the county, if we may except Verdi. Mr. Dunne, the manager, is everything the company could desire. Quiet, prompt, decided, vigilant, and capable, the company may rely on his perfect faithfulness, integrity, and clear judgment. In conclusion, we congratulate Washoe county and the Nevada Mill Company on the future, which now seems so full of promise.

FOREIGN MINES.

FRONTINO AND BOLIVIA (South American) GOLD.—The directors have received the usual advices from the mines (by the present mail), accompanied by a remittance of 571½ ozs. of gold, the produce of the company's mines for the month of March last. The mine reports, &c., will be sent to the shareholders as usual.

IMPERIAL SILVER QUARRIES.—April 26: Owing partly to the nature of the face, and partly to the necessary absence of one of my shifts, and its consequent temporary replacement by another, not acquainted with the rock, I can only report 9 ft. last week, and still in the same formation.

NEVADA.—J. Dunne, May 2: I sent you cable telegram on the 27th inst. of the mill running on Humboldt ore. I started up on that day with eight stamps running 12 hours a day. I hope to run more stamps, but for a week yet will be testing the ore by different processes of amalgation. I have about 100 tons of ore from the Alpha Mine, Humboldt, which I will crush first.

MARIQUITA.—Santa Ana Mines for the month of March: Cost, $7727; returns, $5417. The superintendent writes, under date April 20—We have drawn this month to date 540 skips, or 270 tons, rough ore, and sent 40 tons 12 cwts. to the reduction works, and I fully expect to show a surplus of returns over cost this month.—Marmato Mines for the month of March: Cost, $10,242; returns, $10,096. It is with much regret I have to report that in consequence of the continuation of the dry season our returns remain of low value. The drought has been, perhaps, not unprecedented, but unusually severe. We have the satisfaction, at least, of seeing the ore accumulating on the surface, so that on having a full supply of water the result will be very different.—Aquas Claras Mines for the month of March: Cost, $1384; returns, $2822.

UNITED MEXICAN.—April 21: Mine of Jesus Maria y Jose: The deepest workings in this mine are poor, and as the cost of extraction of ore, rubbish, and water increases as we go down, I find that we are barely paying our expenses in that section of the mine. The work on our reserves is prosecuted cautiously, on account of the dangerous state of the ground. The only new feature in the mine is the discovery of a strip of exceedingly rich ore in the upper wall of the working of Santa Brigida; it is very narrow, but assays from 800 to 1500 marcs per monton, or from 4400 to 8250 ozs. per ton. I have no great hopes of its proving constant, but 2¼ cargas, part good ore and part ordinary, have been sold for $732. The accounts for the quarter ending March show a loss of $5392, but against this we may set a slight increase in the value of stores on hand, and the profit on reduction of the ore, far exceeding the loss on the mine operations.

—— April 23: The good ore in Santa Brigida has somewhat fallen off, and we cannot work on it at present, the place being insecure.—Mine of Remedios (adjoining Jesus Maria y Jose): The two frentes of Santa Domingo and San Joaquin continue in fair ore. The contracielo de San Eligio has fallen off, but gives signs of improvement again. The sales for the two weeks ending the 15th inst. amounted to $2932, and will cover the outlay. Thus far we are doing well, and unless it declines suddenly we may hope to draw some profit from it.—Mine of Encinillas: The frente south has fallen off. The pozo continues in good ore. Owing to a quarrel amongst the workmen some have deserted us; our produce, therefore, has declined again, and on last month's operation there is an excess of outlay of $560.—New Concern: Adit of San Cayetano: The rock continues exceedingly compact, and on April 12 I turned the work 10° more to the southward, with the double object of getting into the lode nearer the junction of the two veins, and of endeavouring to reach more favourable country for advancing. The distance driven in March was nearly 4 metres.—Buenos Ayres: The shaft on April 17 was 53 metres deep, and the rock is not unfavourable for advancing. San Antonio de la Ovejera: We have been obliged to timber part of the old work in the shaft. On the 17th the shaft had attained a depth of 86½ metres. In both shafts the horse-whims are roofed, stables built, and most of the suface work outlay is complete.

CAPULA.—Capt. Paull, April 26: Since my last, of the 6th instant, torta No. 1, of 150 cargas, has been washed, and produced 334 marcs 7 ozs. (2679 ozs.), which we cast in three bars, and sent to Mexico on the 20th, net value, $2994·86. The silver appeared to be very clean, and the bars very white. The result from the torta is very satisfactory. The assay was 24½ marcs per monton (147 ozs. to the ton), and it produced a little over 22¼ (133½ ozs. to the ton), with a moderate loss of quicksilver—10·10 ozs. per marc in the patio. The residues are very low; we washed 5 cargas, from which we only got 5 arrobas of clean polvillos, that assayed 6 marcs per monton (36 ozs. to the ton). The cost of beneficio amounted to $33 per monton; quicksilver, $144·3; salt, 90 arrobas, at $1 = $90; sulphate of copper, 3 quintals, at $50. The other cost was grinding, piso, repaso, lavadero, capellina, &c. The assay from torta No. 2 is 25 marcs per monton (150 ozs. to the ton); we expect about the same from torta No. 3, which will be assayed on Wednesday. The tortas are of the same quantity—100 cargas each; we shall get the silver from both for the conducta to-morrow three weeks. We have sent 140 cargas for No. 4, which we shall complete to-morrow to 150 cargas. There has been more tierras (smalls) sent in this torta than in any former one, consequently it will not be of so high a ley as the others, but torta No. 3 will be equal to Nos. 1 and 2.—San Juan Hacienda: The masons have promised to finish the wheel-pit this week. We have a long piece of wall built, 4 feet thick, against the river. The timber for the wheel is all in order. We have been waiting to have the gudgeons turned at Real del Monte before binding the axle, and commence putting up the wheel. Seeing that we get better results from the patio process than from the barrels, would it not be better to put up a patio at San Juan, and let the power of the wheel go for grinding, instead of moving barrels on one side; we can afterwards put up barrels to the second wheel. If we put barrels to one side of the first wheel, we shall have to remove them afterwards to the second.—The Mine: The ground in the shaft continues very hard. One Englishman has left. We are sinking it by two Englishmen, six Mexicans, and three boys, at $240 per vara. They only sunk 38 centaros in the last fortnight; they certainly had a great deal of ground to square from former weeks. There is no increase of water. One of the branches met with in the cross-cut is cut in the shaft, from which we frequently meet with stones of very good blue ore. The water is nearly all coming from the cross-cut. The ground in San Jorge rise is more favourable, therefore we break a larger quantity of tierras and less gabarro; the same from stopes Nos. 1, 2, and 3, a greater number of castoles of ore are brought out weekly than formerly, but it will take more to the carga, and longer to dress over. The winzes under the Esperanza have been suspended for some weeks, but we have resumed the sinking this week, so as to get some rich ore to mix with metal of lower ley, from the backs, for torta No. 5.

THE PATENT LAWS.—The Lord Chancellor has decided a point of interest to the registrars of patents. An intending patentee had lodged a provisional specification, when another inventor filed one of a similar description, and procured his patent to be the first sealed. The former complained of this, and argued that under the circumstances the Attorney-General should not have allowed the second person to file his patent. The Lord Chancellor, however, pointed out that there was no law to compel a person who had filed a provisional specification to proceed with his invention, and if the applications of other parties were to be uniformly rejected, the country might be deprived of the fruits of the ingenuity of many minds which were working in the same direction.

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